IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Before the Board of Patent Appeals and Interferences

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In re Patent Application of
McLAUGHLIN et al.
Serial No. 09/043,171
Filed: March 12, 1998
Title: WAVEFORM SYNTHESIS

OIPE JC25 JAN 04 2005 PATENT & TRADEMARK OFFICE

Atty Dkt. 36-1136
C# M#
TC/A.U.: 2654
Examiner: Azad, A.
Date: January 4, 2005

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

☐ **Correspondence Address Indication Form Attached.**

☐ **NOTICE OF APPEAL**
Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the Examiner twice/finally rejecting applicant's claim(s). $500.00 (1401)/$250.00 (2401) $

☒ An appeal **BRIEF** is attached in the pending appeal of the above-identified application $500.00 (1402)/$250.00 (2402) $ 500.00

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☐ A reply brief is attached in triplicate under Rule 41.41 **(no fee)**

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1100 North Glebe Road, 8th Floor
Arlington, Virginia 22201-4714
Telephone: (703) 816-4000
Facsimile: (703) 816-4100
CC:lmr

NIXON & VANDERHYE P.C.
By Atty: Chris Comuntzis, Reg. No. 31,097

Signature:

913365

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McLAUGHLIN et al. Atty. Ref.: 36-1136

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APPEAL BRIEF

Appellant hereby appeals the Final Rejection of October 6, 2004.

REAL PARTY IN INTEREST

The real parties in interest is Appellant, British Telecommunications, plc.

RELATED APPEALS AND INTERFERENCES

The Appellant and the undersigned are not aware of any related appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF THE CLAIMS

Claims 1-11 and 16-20 remain pending in this application. Claims 1-11 and 16-20 stand rejected by the Examiner, the rejections of which are appealed. All of the claims are presented in the Appendix I to this Brief.

STATUS OF ANY AMENDMENT FILED SUBSEQUENT TO ANY FINAL REJECTION

No amendments have been filed subsequent to the Final Rejection.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent claims 1 and 18 are directed to a method and an apparatus, respectively for generating a cyclical sound waveform. More particularly, the method and apparatus involve first generating a cyclical sound waveform sample and then generating a successive cyclical sound waveform sample from the first cyclical sound waveform sample and transformation data. Thereafter, the successive cylindrical waveform sample is defined as a cyclical sound waveform sample and the process is repeated for a number of cycles to generate a sequence of successive cyclical waveform samples. Finally, the sequence of samples is output to generate a waveform representing a cyclical sound. The claim 1 and 18 embodiments are shown and described, *inter alia*, at Figures 6-12 and page 6, line 16 through page 10, line 21 of the present specification.

Independent claims 16 and 17 are directed to methods of generating a synthetic voiced speech waveform. More particularly, claim 16 involves first storing data defining n-dimensional state space representations of voiced speech signals, then selecting a synthesized waveform starting point in said n-dimensional state space representation of predetermined voiced speech waveform, the starting point being offset from the stored data by an offset vector, selecting successive further synthesized waveform points specifically related to the previously selected point, repeating the process and then outputting the resulting sequence to generate a voiced speech waveform. Claim 17 involves first storing data defining n-dimensional state space representations of voiced speech signals, then generating synthesized waveform points from said n-dimensional state space representations, repeating the process to generate successive points, and then outputting the sequence to generate a voiced speech waveform. The claim 16 and 17 embodiments are shown and described, *inter alia*, at Figures 6-12 and page 10, line 23 through page 14, line 9 of the present specification.

Independent claims 19 and 20 are directed to a method and an apparatus, respectively, for generating a cyclical sound waveform corresponding to a sequence of substantially similar cycles. More particularly, the method and apparatus involve generating a first instantaneous value of the amplitude of a

cyclical sound waveform and then generating a second instantaneous value of the amplitude of a cyclical sound waveform from the first instantaneous value and transformation data. Thereafter, the second instantaneous value is defined as first instantaneous value and the process is repeated to generate a sequence of said instantaneous values. Finally, the sequence of instantaneous values is output to generate a waveform representing a cyclical sound. The claim 19 and 20 embodiments are shown and described, *inter alia*, at Figures 6-12 and page 6, line 16 through page 10, line 21 of the present specification.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1-4, 7-11 and 18 are anticipated under 35 U.S.C. § 102(e) by Otsuka et al. (U.S. Pat. No. 5,745,651).

Whether claims 5, 6, 16 and 17 are made obvious under 35 U.S.C. § 103(a) by Otsuka et al. in view of Kleijn et al. (Speech Coding and Synthesis).

Whether claims 19 and 20 are made obvious under 35 U.S.C. § 103(a) by Mitsumi (U.S. Pat. No. 4,635,520) in view of Otsuka et al.

WHETHER THE CLAIMS STAND OR FALL TOGETHER

With respect to the § 102 rejection, claims 1-11 stand or fall together and 18 stands or falls alone.

With respect to the § 103 rejections, independent claims 16, 17, 19 and 20 stand or fall independently. Dependent claims 5 and 6, which depend from believed allowable claim 1, stand or fall together with claim 1.

ARGUMENTS WITH RESPECT TO THE ISSUES PRESENTED FOR REVIEW

Rejection under 35 U.S.C. § 102

The Examiner's Final Office Action has improperly rejected claims 1-4, 7-11 and 18 as being anticipated under 35 U.S.C. § 102(e) by U.S. Patent No. 5,745,651 to Otsuka et al.

Under 35 U.S.C. § 102, a patent claim is invalid if it is anticipated by a single prior art reference. *Glaxo Inc. v. Novopharm Ltd.*, 52 F.3d 1043, 1047, 34 USPQ2d 1565, 1567 (Fed. Cir. 1995). To anticipate a patent claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently. *In Re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997).

The Examiner has finally rejected claims 1 and 18. Both claims I and 18 include the claim feature of "a cyclical sound waveform sample." A "waveform" is defined in the Federal Standard 1037C, Glossary of Telecommunications Terms, 1996 as "the representation of a signal as a plot of amplitude versus time." A "sound waveform" is therefore a representation of a sound signal as a plot of amplitude versus time and a "cyclical sound waveform" is therefore a sound waveform "occurring in cycles." Federal Standard 1037C also defines a "signal

sample" as "the value of a particular characteristic of a signal at a chosen instant."

The US Manual of Patent Examining Procedure, at section 2111.01, states that claim terms are presumed to have the ordinary and customary meanings attributed to them by those of ordinary skill in the art. The MPEP also states at section 2141.03 that the person "having ordinary skill in the art to which the claimed subject matter pertains would, of necessity have the capability of understanding the scientific and engineering principles applicable to the pertinent art."

The claim feature "cyclical sound waveform sample" would therefore be interpreted by one of ordinary skill in the art as the value of the amplitude of a cyclical sound signal at a chosen instant in time. It is also worth pointing out at this stage that this accords with the second of the definitions given by the Examiner in section 9 of the Final Office Action.

> The word "sample" defined in "The authoritative Dictionary of IEEE Standards and Terms" seventh edition, 2000. Page 1000 as "one or more units of product drawn from a lot, the units of sample being selected and random without regard to their quality" also define sample data as "<u>data in which the information content can be, or is, ascertained only at discrete intervals of time</u>." (Emphasis supplied.)

Of the two definitions cited by the Examiner it should be clear that the second definition (underlined above), namely, "data in which the information content can be, or is, ascertained only at discrete interval of time" applies here. In fact this

definition is analogous to the definition submitted by Appellant above, i.e., "the value of a particular characteristic of a signal at a chosen instant." The word "discrete", according to the Concise Oxford Dictionary 10th edition, means 'individually separate and distinct." Therefore, even according to the Examiner's definition, a waveform sample is the information associated with the waveform which has been ascertained at an individually separate and distinct interval of time. A person of ordinary skill in the art, having read the description of the present application, and even accepting the definition cited by the Examiner would readily recognize that the cited art does <u>not</u> generate a cylindrical sound waveform sample as required by independent claims 1 and 18.

Indeed, the Examiner has failed to clearly indicate where the claim feature of a "cyclical sound waveform sample", as interpreted above, can be found in Otsuka et al. At times the Examiner seems to suggest that this claim feature is anticipated by the feature in Otsuka of "a parameter of a frame to be processed." However, a parameter of a frame to be processed is extracted from a parameter series. A parameter series is generated for each frame and an example of the data contained within a parameter series is given in Figure 8 of the actual reference. It is clear from this figure that a parameter series comprises three separate parameters all of which apply over one whole frame. In the first instance, since the parameters all apply over one whole frame, they <u>cannot</u> be described as a value of the aptitude of a speech signal at a chosen instant, i.e.,

as a <u>sample</u>. In the second instance none of the three parameters comprise a cyclical sound waveform. Therefore, in no way can a parameter of a frame to be processed, as found in Otsuka et al., be said to anticipate the claim feature of generating a "cyclical sound waveform sample."

Moreover, assuming arguendo that Otsuka et al. discloses "generating a cyclical sound waveform sample" where does Otsuka et al. disclose the second element of claims 1 and 18, namely, "generating a successive cyclical sound waveform sample and transformation data, wherein said transformation data comprise data defining the evolution of said cycles in a temporal vicinity of said cyclical sound waveform and the change in shape of said cycles in said temporal vicinity from cycle to cycle. This feature of Appellant's inventions is clearly shown and described at Figures 7-12 and page 18, line 1, through page 14, line 9 of the present application. The Examiner relies on Figure 15, element S317 of Otsuka et al. which actually refers to a "pitch waveform" and <u>not</u> to a "successive cyclical sound waveform sample" as disclosed and claimed in the present application.

Indeed, it is error for the Examiner to suggest that the Otsuka et al. feature of a "pitch waveform" anticipates the claim feature "cyclical sound waveform sample." As will be clear from the above discussion of the term "cyclical sound waveform sample," a pitch waveform cannot be said to be a waveform <u>sample</u>. The Examiner's interpretation of the feature pitch waveform to be a "cyclical sound waveform sample" is inconsistent with what the Examiner has written in

section 9 of the Office Action, where he states that the term pitch waveform "is substantially similar cycles", yet another claim feature of claims I and 18. Taking all the above into account, it is submitted that both claims 1 and 18 define novel and inventive subject matter over Otsuka et al. Dependent claims 2 to 11 are all dependent on independent claim I and are therefore arguably novel and inventive at least by virtue of that dependency.

Rejections Under 35 U.S.C. § 103

Under 35 U.S.C. §103, a patent claim is invalid if the differences between its subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. *Litton Systems Inc. v. Honeywell Inc.*, 87 F.3d 1559, 1566, 39 USPQ2d 1321, 1325 (Fed. Cir. 1996).

The determination of obviousness is a question of law based on underlying factual inquiries. *Kegel Co. v. AMF Bowling Inc.*, 127 F.3d 1420, 1430, 44 USPQ2d 1123, 1130 (Fed. Cir. 1997). The ultimate determination as to obviousness is based on four factual inquiries: the scope and content of the prior art, the differences between the claims and the prior art, the level of ordinary skill in the pertinent art, and secondary considerations, if any, of non-obviousness. *Id.*

A. Otsuka et al. in view of Kleijn et al.

The Examiner has improperly rejected claims 5, 6, 16 and 17 as being unpatentable over Otsuka et al. in view of Kleijn et al.

Independent claims 16 and 17 include the claim feature of "state space representations of voiced speech signals" and the Examiner contends that Otsuka et al. teaches said claim feature. In a state space representation, different axes of state space consist of waveform values separated by predetermined timed intervals, so that a time in state space is defined by a set of values at times t_1, t_2, t_3 (where t_2-t_1=Δt_1 and t_3-t_2=Δt_2, which are both constants and may be equal). In the example given on pages 4 and 5 of the present application to produce a state space representation of a time sequence X, a plurality of values (in this case three) of a waveform at spaced apart times X_{i-10}, x_i, x_{i+10} are taken and combined to represent a single point s_i, in a space defined by a corresponding number of axis (in this case three). This is totally different from simply an amplitude versus time plot of a waveform (as shown in Figure 11 of Otsuka et al. and cited by the Examiner), which cannot under any circumstances be said to be even a two dimensional state space representation. Otsuka, therefore, does not teach the claim feature of "state space representations of voiced speech signals" and therefore even if it would have been obvious to combine Otsuka et al. with Kleijn, Appellant's inventions would not have resulted. The Examiner has, therefore, failed to establish a prima facie case of obviousness against claims 16 and 17.

As noted above, dependent claims 5 and 6 are believed to patentably define over the cited art by virtue of their dependency on claim 1.

B. Mitsumi et al. in view of Otsuka et al.

The Examiner has improperly rejected claims 19 and 20 under 35 U.S.C. § 103(a) as being unpatentable over Mitsumi in view of Otsuka et al.

Mitsumi discloses a device that is operable to smoothly connect together a repetitively output waveform. This is achieved by an interpolation operation in specified sections at the end and start of the waveform that smoothes the amplitude change of the waveform in the interpolation section. The passage cited by the Examiner (column 3, lines 30 to 63) describes how there is a discontinuity between a section at the end of a repeated cycle and a section B at the beginning of a next repeated cycle. In this area of discontinuity a wave shape signal based on an approximate value obtained by an interpolation operation is used thus smoothly connecting sections A and B. Where in this section of Mitsumi does it disclose "generating a first instantaneous value of the amplitude of a cyclical sound waveform" and subsequently "generating a second instantaneous value of the amplitude of a cyclical sound waveform from said first instantaneous value." Furthermore, and as already mentioned above, Mitsumi discloses a device that is operable to smoothly connect together a repetitively output waveform. This is precisely the sort of device that the present invention seeks to improve upon by eliminating the need to record stored segments of a waveform and outputting them in sequence (see present application at page 1,

lines 5 to 20). There will thus be no motivation to modify Mitsumi since there would be no reasonable expectation of success in providing a waveform synthesizer that avoids the unnatural sound that results from repeating a short segment of a recorded sound several times in sequence. The Examiner has, therefore, failed to establish a prima facie case of obviousness against independent claims 19 and 20.

CONCLUSION

For all of the reasons set forth above, it is respectfully requested that this appeal be granted and that the rejection discussed above be reversed.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: ______________________
Chris Comuntzis
Reg. No. 31,097

CC:lmr
1100 North Glebe Road, 8th Floor
Arlington, VA 22201-4714
Telephone: (703) 816-4000
Facsimile: (703) 816-4100

APPENDIX OF CLAIMS ON APPEAL

1. A method of generating a cyclical sound waveform corresponding to a sequence of substantially similar cycles, said method comprising:

(a) generating a cyclical sound waveform sample;

(b) generating a successive cyclical sound waveform sample from said cyclical sound waveform sample and transformation data, wherein said transformation data comprise data defining the evolution of said cycles in a temporal vicinity of said cyclical sound waveform and the change in shape of said cycles in said temporal vicinity from cycle to cycle;

(c) designating said successive cyclical sound waveform sample as a cyclical sound waveform sample and repeating (b);

(d) repeating (c) a plurality of times to generate a sequence of said successive cyclical sound waveform samples corresponding to a plurality of said cycles; and

(e) outputting the samples of said sequence to generate a waveform representing a cyclical sound.

2. A method according to claim 1, in which said waveform comprises voiced speech.

3. A method according to claim 1 in which said transformation data does so by reference to a predetermined reference waveform sequence.

4. A method according to claim 3, in which said reference waveform sequence comprises a stored speech waveform.

5. A method according to claim 1, in which said steps (a) and (b) comprise generating a plurality of values representing said waveform sample values as a point in a multidimensional space in which corresponding portions of successive said cycles are substantially superposed.

6. A method according to claim 5 in which said transformation data does so by reference to a predetermined reference waveform sequence and in which said transformation data represents a transformation which approximates a transformation which would transform a first displacement vector, extending from a first time point on said reference waveform sequence to a corresponding time point on the waveform to be synthesised, to a second displacement vector extending from a second point, successive to the first, on said reference waveform sequence to a corresponding second point on the waveform to be synthesised.

7. A method according to claim 3, in which a given successive waveform sample is derived in accordance with data from a point on said reference waveform sequence at a position within a said cycle which corresponds to that of said given successive waveform sample, and at least one other point on said reference waveform sequence offset in time therefrom.

8. A method according to claim 1, in which said step (b) comprises calculating said transformation data from a set of stored waveform values.

9. A method according to claim 1, in which the initial performance of said step (a) to initial synthesis of said waveform comprises a step of selection of an initial value which differs from a previous initial value selected on a previous synthesis of said waveform.

10. A method according to claim 9 in which said selection step comprises applying a pseudo random number generation algorithm to select said value.

11. A method according to claim 9 in which said step of selection comprises referring to a stored waveform sample value and calculating a synthesised initial waveform value similar but different to said stored waveform value.

16. A method of generating a synthetic voiced speech waveform, said method comprising:

(a) storing data defining n-dimensional state space representations of voiced speech signals, n being an integer having a value of at least three, in which successive voiced speech pitch pulse cycles are superimposed to provide a model of voiced speech dynamics;

(b) selecting a synthesized waveform starting point in said n-dimensional state space representation for a predetermined voiced speech waveform that is offset from said stored data by an offset vector;

(c) selecting successive further synthesized waveform points in said n-dimensional state space representation for said predetermined voiced speech waveform that are also respectively offset from said stored data in dependence jointly upon the preceding point in the synthesized sequence, nearest other stored points in state sequence space and an offset vector therefrom;

(d) repeating (b) and (c) for plural voiced speech pitch cycles; and

(e) outputting the resulting sequence of thus synthesized waveform points to generate a voiced speech waveform.

17. A method of generating a synthetic voiced speech waveform, said method comprising:

(a) storing data defining n-dimensional state space representations of plural voiced speech waveform portions, n being an integer having a value of at least three, in which successive voiced speech pitch pulse cycles are superimposed in n-dimensional state space to provide a model of voiced speech dynamics;

(b) generating synthesized waveform points using said n-dimensional state space representation for a predetermined voiced speech waveform portion,

(c) repeating (b) for plural successive different predetermined voiced speech waveform portions; and

(d) outputting the resulting sequence of thus synthesized waveform points to generate a voiced speech waveform.

18. Synthesis apparatus comprising:

(a) means for generating a cyclical sound waveform sample;

(b) means for generating a successive cyclical sound waveform sample from said cyclical sound waveform sample and transformation data, wherein said transformation data comprise data defining the evolution of said cycles in a temporal vicinity of said cyclical sound waveform and the change in shape of said cycles in said temporal vicinity from cycle to cycle;

(c) means for designating said successive cyclical sound waveform sample as a cyclical sound waveform sample and repeating (b);

(d) means for repeating (c) a plurality of times to generate a sequence of said successive cyclical sound waveform samples corresponding to a plurality of said cycles; and

(e) means for outputting the samples of said sequence to generate a waveform representing a cyclical sound.

19. A method of generating a cyclical sound waveform corresponding to a sequence of substantially similar cycles, said method comprising:

(a) generating a first instantaneous value of the amplitude of a cyclical sound waveform;

(b) generating a second instantaneous value of the amplitude of a cyclical

sound waveform from said first instantaneous value and transformation data, wherein said transformation data comprise data defining the evolution of said cycles in the temporal vicinity of said cyclical sound waveform and the change in shape of said cycles in said temporal vicinity from cycle to cycle;

(c) designating said second instantaneous value as a first instantaneous value and repeating (b);

(d) repeating (c) a plurality of times to generate a sequence of said instantaneous values corresponding to a plurality of said cycles; and

(e) outputting the instantaneous values of said sequence to generate a waveform representing a cyclical sound.

20. Synthesis apparatus comprising:

(a) means for generating a first instantaneous value of the amplitude of a cyclical sound waveform;

(b) generating a second instantaneous value of the amplitude of a cyclical sound waveform from said first instantaneous value and transformation data, wherein said transformation data comprise data defining the evolution of said cycles in the temporal vicinity of said cyclical sound waveform and the change in shape of said cycles in said temporal vicinity from cycle to cycle;

(c) designating said second instantaneous value as a first instantaneous value and repeating (b);

(d) means for repeating (c) a plurality of times to generate a sequence of said instantaneous values corresponding to a plurality of said cycles; and

(e) outputting the instantaneous values of said sequence to generate a waveform representing a cyclical sound.